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## Test 786: Case 531C (Diesel)

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# NEBRASKA TRACTOR TEST 786 - CASE 531C DIESEL

The University of Nebraska Agricultural Experiment Station

E. F. Frolik, Dean; A. W. Epp, Acting Director, Lincoln, Nebraska

## POWER TAKE-OFF PERFORMANCE

Hp	Crank shaft speed rpm	Fuel Consumption		Hp-hr per gal	Temp. Degrees F			Barometer inches of mercury
		Gal per hr	Lb per hp-hr		Cool- ing med	Air wet bulb	Air dry bulb	
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours								
40.26	2100	2.726	0.468	14.77	186	59	75	28.935
Standard Power Take-off Speed (540 rpm)—One Hour								
39.05	1966	2.577	0.456	15.15	185	59	75	28.893
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
35.81	2198	2.558	0.493	14.00	181	59	75	.....
0.00	2258	0.903	.....	.....	155	58	74	.....
18.13	2226	1.728	0.659	10.49	173	58	74	.....
40.13	2100	2.727	0.469	14.72	186	59	75	.....
9.14	2243	1.285	0.972	7.11	170	58	74	.....
26.99	2207	2.137	0.547	12.63	180	58	74	.....
Av 21.70	2205	1.890	0.602	11.48	174	58	74	28.855

## DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank shaft speed rpm	Slip of drivers %	Fuel Consumption		Hp-hr per gal	Temperature Degrees F			Barometer inches of mercury
					Gal per hr	Lb per hp-hr		Cooling medium	Air wet bulb	Air dry bulb	
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—5th Gear											
35.59	2771	4.82	2101	4.30	2.719	0.528	13.09	169	53	63	28.260
30.81	3521	3.28	2040	5.31	2.678	0.600	11.50	176	54	63	Torq. Conv.
75% of Pull at Maximum Power—Ten Hours and Two Hours—5th Gear											
28.63	2098	5.12	2200	2.77	2.439	0.589	11.74	167	49	55	28.366
50% of Pull at Maximum Power—Two Hours—5th Gear											
28.99	2666	4.08	2193	3.79	2.690	0.641	10.78	163	31	36	Torq. Conv.
19.65	1414	5.21	2219	1.86	2.039	0.717	9.64	160	41	45	28.595
19.62	1785	4.12	2213	2.52	2.260	0.796	8.68	157	29	34	Torq. Conv.
MAXIMUM POWER WITH BALLAST											
30.60	6058	1.89	2197	14.74	1st Gear	.....	160	41	44	44	28.585
35.71	4682	2.86	2103	8.49	2nd Gear	.....	162	41	44	44	28.585
36.22	4296	3.16	2098	7.55	3rd Gear	.....	169	41	44	44	28.585
35.13	3399	3.88	2103	5.72	4th Gear	.....	170	51	60	60	28.325
35.67	2792	4.79	2098	4.54	5th Gear	.....	171	51	60	60	28.325
35.17	2065	6.39	2099	3.33	6th Gear	.....	170	51	60	60	28.325
24.47	6035	1.52	2202	14.84	1st Gear	Torq. Conv.	161	41	44	44	28.585
30.97	5044	2.30	2144	9.53	2nd Gear	Torq. Conv.	166	43	48	48	28.520
31.65	4981	2.38	2103	9.26	3rd Gear	Torq. Conv.	169	48	56	56	28.405
31.21	4133	2.83	2089	7.33	4th Gear	Torq. Conv.	170	48	56	56	28.405
32.35	3568	3.40	2077	5.95	5th Gear	Torq. Conv.	173	48	56	56	28.405
31.59	2594	4.57	2059	4.00	6th Gear	Torq. Conv.	171	51	60	60	28.325
MAXIMUM POWER WITHOUT BALLAST											
35.32	2850	4.65	2100	10.21	5th Gear	.....	165	36	45	45	28.860
29.75	3067	3.64	2159	14.87	5th Gear	Torq. Conv.	165	36	45	45	28.860

<b>VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—5th Gear</b>							
Pounds pull	2800	2950	3100	3200	3300	3300	
Horsepower	35.7	33.8	31.4	28.2	24.6	21.1	
Miles per hour	4.8	4.3	3.8	3.3	2.8	2.4	
Pounds pull (Torq. Conv.)	3550	4000	4300	4650	5000	5350	5700
Horsepower (Torq. Conv.)	32.4	32.0	31.0	29.8	28.0	24.3	19.8
Miles per hour (Torq. Conv.)	3.4	3.0	2.7	2.4	2.1	1.7	1.3

<b>TIRES, BALLAST and WEIGHT</b>			<b>With Ballast</b>	<b>Without Ballast</b>
Rear tires	—No, size, ply & psi		Two 14.9-28;6;18	Two 14.9-28;6;14
Ballast	—Liquid		554 lb each	None
	—Cast iron		1260 lb each	None
Front tires	—No, size, ply & psi		Two 5.50-16;4;28	Two 5.50-16;4;28
Ballast	—Liquid		None	None
	—Cast iron		None	None
Height of Drawbar			15 inches	16 1/2 inches
Static weight	—Rear		6542 lb	2914 lb
	—Front		1470 lb	1448 lb
Total weight with operator			8187 lb	4537 lb

## Department of Agricultural Engineering

Dates of Test: April 6 to April 18, 1961

Manufacturer: J. I. CASE COMPANY, RACINE, WISCONSIN

Manufacturer's Power Rating: 40 Belt Horsepower (corrected to Standard Conditions)

FUEL, OIL and TIME Fuel No 2 Diesel Cetane No 54 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8297 Weight per gallon 6.908 lb Oil SAE 20-20W API service classification DS To motor 1.500 gal Drained from motor 0.840 gal Transmission and final-drive lubricant SAE 90 Type multi-purpose gear lubricant (E.P.) Total time engine was operated 50 hours.

ENGINE Make Case Diesel Type 4 cylinder vertical Serial No 611-S0-4332 Crankshaft mounted lengthwise Rated rpm 2100 Bore and stroke 3 13/16" x 4 1/2" Compression ratio 17.5 to 1 Displacement 188.4 cu in Cranking system 12 volt electric (two 6 volt batteries) Lubrication pressure Air cleaner oil washed wire mesh Oil filter replaceable treated paper element Oil cooler engine coolant heat exchanger for torque converter oil Fuel filter replaceable treated paper element Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type tricycle Serial No 6153231 Tread width rear 48" to 88" front 6 1/2" to 11 1/2" Wheel base 86 1/4" Center of gravity (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 27.4" Vertical distance above roadway 31.4" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio plus torque converter with lockout Advertised speeds mph first 1.87 second 2.74 third 3.11 fourth 3.61 fifth 4.57 sixth 6.01 seventh 8.91 eighth 14.84 reverse 2.22 and 3.70 Clutch multiple disc main hydraulic power-clutch operated by piston through foot pedal control valve and single disc direct drive hydraulic clutch, locking turbine to engine through hand operated control valve. Brakes double disc operated by two foot pedals Steering power assisted Turning radius (on concrete surface with brake applied) right 95" left 95" (on concrete surface without brake) right 95" left 95" Turning space diameter (on concrete surface with brake applied) right 205" left 205" (on concrete surface without brake) right 205" left 205" Belt pulley 1195 rpm at 2100 engine rpm diam 10 1/4" face 6" Belt speed 3210 fpm Power take-off 541 rpm at 1970 engine rpm.

REPAIRS and ADJUSTMENTS No repairs or adjustments.

REMARKS All test results were determined from observed data obtained in accordance with the SAE, and ASAE test code.

Only 12 gears, as selected by the manufacturer's representative, are used in making the maximum power runs with ballast.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 786.

L. F. LARSEN  
Engineer-in-Charge

L. W. HURLBUT  
G. W. STEINBRUEGGE  
J. J. SULEK  
Board of Tractor  
Test Engineers



## EXPLANATION OF TEST REPORT

### GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories can be disconnected only when it is convenient for the operator to do so in practice. Additional weight can be added as ballast if the manufacturer regularly supplies it for sale. The static tire loads and the inflation pressures must conform to recommendations in the Tire Standards published by the Society of Automotive Engineers.

### PREPARATION FOR PERFORMANCE RUNS

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operators manual. The fuel used and the maintenance operations must also conform to the published information delivered with the tractor. The tractor is then limbered-up for 12 hours on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

The tractor is equipped with approximately the amount of added ballast that is used during maximum drawbar tests. The tire tread-bar height must be at least 65% of new tread height prior to the maximum power run.

### BELT OR POWER TAKE-OFF PERFORMANCE

**Maximum Power and Fuel Consumption.** The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever is set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the belt pulley or the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power. The corresponding fuel consumption is measured.

**Varying Power and Fuel Consumption.** Six different horsepower levels are used to show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85% of the dynamometer torque at maximum power; minimum dynamometer torque,  $\frac{1}{2}$  the 85% torque; maximum power,  $\frac{1}{4}$  and  $\frac{3}{4}$  of the 85% torque. Since a tractor is generally subjected to varying loads the average of the results in this test serve well for predicting the fuel consumption of a tractor in general usage.

### DRAWBAR PERFORMANCE

All engine adjustments are the same as those used in the belt or power take-off tests. If the manufacturer specifies a different rated crankshaft speed for drawbar operations, then the position of the manually operated governor control is changed to provide the high-idle speed specified by the manufacturer in the operating instructions.

**Varying Power and Fuel Consumption With Ballast.** The varying power runs are made to show the effect of speed-control devices (engine governor, automatic transmissions, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree

turns with a minimum radius of 50 feet. The drawbar pull is set at 3 different levels as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum power; and (3) 50% of the pull at maximum power. Prior to 1958, fuel consumption data (10 hour test) were shown only for the pull obtained at maximum power for tractors having torque converters and at 75% of the pull obtained at maximum power for gear-type tractors.

**Maximum Power with Ballast.** Maximum power is measured on straight level sections of the test course. Data are shown for not more than 12 different gears or travel speeds. Some gears or travel speeds may be omitted because of high slippage of the traction members or because the travel speed may exceed the safe-limit for the test course. The maximum safe speed for the Nebraska Test Course has been set at 15 miles per hour. The slippage limits have been set at 15% and 7% for pneumatic tires and steel tracks or lugs, respectively. Higher slippage gives widely varying results.

**Maximum Power Without Ballast.** All added ballast is removed from the tractor. The maximum drawbar power of the tractor is determined by the same procedure used for getting maximum power with ballast. The gear (or travel speed) is the same as that used in the 10-hour test.

**Varying Power and Travel Speed with Ballast.** Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions: (1) maximum pull is obtained, (2) the maximum slippage limit is reached, or (3) some other operating limit is reached.

For additional information about the **Nebraska Tractor Tests** write to the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska.



Case 531C Diesel